HF100 • HF100H

SERVICE MANUAL

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HF100/HF100H SERVICE MANUAL

This manual is established for repair·adjustment of portable x-ray device HF100 and HF100H.

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1. Introduction

This service manual is applied for HF100 and HF100H x-ray unit.

HF100H is human use version. But there are mechanical and electric parts which are not exchangeable. So, replacement on repair should be done carefully.

Major difference between HF100 and HF100H are as follows.

Parts	HF100	HF100H
Collimator mounting ring	for R-120H	for R70
Key board P.C.Board (M3107A)	20mA	for HF100H
Timer P.C.Board (M3108A)	20mA fixed type	for HF100H
Control P.C.Board (M9112)	exchangeable	exchangeable
Inverter (M9111)	exchangeable	exchangeable
Insert Box	exchangeable	exchangeable
Collimator transformer	for R-120H	for R70

2. SPECIFICATIONS

POWER :	Range ----------	100 ~ 130VAC
	Minimum voltage with no load ---------	100VAC
	Maximum voltage with no load --------	140VAC
	Frequency ----------	50/60Hz
	Electricity consumption at 120V ------	minimum 20A (40kV) maximum 32A (100kV)
	Maximum voltage consumption --------	3.5kVA ±10%

NOTE : This unit would be severely damaged if it is used with incorrect line voltage.

OUTPUT :	Inverter :	120kHz high frequency inverter system with neutral ground circuit, 2kW · 60kHz inverter. tube potential feedback system tolerance ±3kV or ±10%
	Filament circuit :	0.5 Watt · 45kHz inverter tube current feedback system tolerance ±10% pre-heat time : approximately 2sec.

WARM UP TIME : Approximately 10 seconds after each exposure and after the initial Power On.

X-RAY OUTPUT :	Maximum tube voltage :	100kV ±10% (adjusted at 97.5 – 99kV)
	Minimum tube voltage :	40kV ±10% (adjusted at 41 – 39kV)
	kV switch :	2kV steps
	tube current :	20mA ±10% constant (adjusted at 19mA)
	timer range - HF100 :	0.01 – 2.00 sec. 0.01 sec. steps
	HF100H :	0.08 – 4.00 sec. 0.01 sec. steps (adjusted at each value ±1% of time base pulse of 100Hz)

X-RAY TUBE :	TOSHIBA D-124S	
	focal spot size :	1.2mm×1.2mm
	target material :	tungsten
	angle :	16°
	anode heat storage capacity :	14kJ (20.0kHU)

COLLIMATOR : Continuously adjustable light beam type with central ray indicator, and cassette size/distance to aid in correct positioning.

R-120H	On time :	90 sec.
	bulb :	Fuji Lamp Inc. , No. JC12V40W
	product life :	longer than 50 hours
	Illuminance :	over 160 lux at 21" SID
	Contrast ratio :	over 3:1 at 3:1 at 21" SID
R70	Refer instruction manual of Advantech.	

FILTRATION :

inherent filtration	2.2mm Al
collimator filtration	0.5mm Al
total filtration	2.7mm Al

WEIGHT : HF100 ----- 16.5kgs
HF100H --- 18.5kgs

SIZE : HF100 --- 29 cm (W) × 23 cm (H) × 40.0 cm (L)
HF100H --- 29 cm (W) × 23 cm (H) × 38.5 cm (L)

POWER CORD : 3.6m

EXPOSURE CORD : 3.0m

3. OPERATING PROCEDURES

CONNECTION : After confirming POWER CORD and EXPOSURE SWITCH are usual condition, connect them to main body of x-ray unit certainly.
(If connector has lock, confirm it is locked.)

Confirm POWER SWITCH is OFF and connect POWER CORD to wall receptacle of proper mains.
(When you used extension cord, 3.5kW should be obtained.)

POWER ON : Set POWER SWITCH on control panel to on, then each indicator will be turned on. When the unit is warming up, exposures can not be taken. After approx. 10 sec., WARM UP indicator will go off. The unit is now ready to use.

CAUTION
DO NOT SWITCH ON AND OFF QUICKLY IN A SHORT TIME. WHEN TURNING ON AGAIN AFTER TRUNING OFF, WAIT FOR AT LEAST 1 MINUTE. OTHERWISE, HIGH FREQUENCY INVERTER CANNNOT WORK PROPERLY.

kV SETTING : Set kV in the range of 40kV to 100kV.

TIMER SETTING : Set timer in the range of (HF100 : 0.01 sec. to 2.00 sec.)(HF100H : 0.08 to 4.00 sec.) depends on subject, distance and screen/film combination.
Time increments are 0.01 sec.

ADJUSTMENT OF RADIATION FIELD :
Pressing the collimator switch will illuminate the field for approx. (HF100 : 90sec.) (HF100H : 30 sec). Adjust light field to position of radiograph by two knobs for adjustment of opening. During this time, use the adjustment knobs to size the radiograph as you need.

RADIOGRAPHY :
Make sure that WARM UP indicator is OFF before pressing exposure switch.

CAUTION
WARM UP INDICATOR BECOMES OFF AFTER 10 SEC. FROM POWER ON.
WARM UP INDICATOR BECOMES OFF AFTER 10 SEC. FROM EACH EXPOSURE.
IF WARM UP INDICATOR IS ON, RADIOGRAPHY IS IMPOSSIBLE.

Make sure all WARNING LAMPS are off.
After all safety checks, press only first stage of EXPOSURE SWITCH.
STANDBY indicator goes off after 1 sec. Then, unit is ready for exposure.
Press second stage of EXPOSURE SWITCH. X-RAY indicator is lit and radiography is executed for the time set.
The EXPOSURE SWITCH is a DEDMAN style. So, if the button is released, exposure is stopped. So, hold the button until exposure is complete.

WARM UP indicator will light after exposure.

X-RAY BUZZER is ON and OFF (only HF100).

NOTE : **The first stage of EXPOSURE SWITCH is pre-heat of filament.**
DON'T KEEP ONLY FIRST STAGE OF EXPOSURE SWITCH "ON" LONGER THAN 30 SEC.

POWER OFF : When the POWER SWITCH is pressed, all of indicators on the control panel are off.

WARNING LAMP : HF100/HF100H have 2 kinds of warning lamps. If either of them is lit, x-ray cannot be generated. Each detail is as follows.

KIND OF WARNING LAMP	DETAILS	COUNTERMEASURE
WARM UP	The internal circuit is warming up.	Wait until light goes off.
ERROR	Unit malfunction.	Stop exposing and follow steps below.

※ If ERROR indicator is lit even when EXPOSURE SWITCH BUTTON is released, it means an unusual situation has been occurred. Therefore, turn off POWER SWITCH, wait 3 minutes, then start procedures over again.

※ This unit generates x-ray by an inverter. Therefore, it requires warm up time to be stable after power on and each exposure.

When WARM UP indicator is off, warm up is finished.

4. PRE-ADJUSTMENT

*** Each PC Boards deliverd from Mikasa Factory have already been adjusted.**

1. 24VDC power supply adjustment (SVB24SB)
Check output (DCV) at Red (+) and Black (-) wires. Adjust VR to be 24VDC ±0.3V.

2. M3108A adjustment (refer page 7)

kV adjustment: kV is decreased by turning clockwise.

1. This adjustment is need the special test equipment (HF tester).
2. Check the DC voltage between the kV test point (+) and (-) on the HF tester.
3. Set the kV selector to 100kV and turn VR1 (M3108A) so that the DC voltage is 5.0 VDC.
4. Check the each kV.
5. Finaly check the kV by using an external kV tester such as the Victoreen NERO. The readings will indicate a little lower than the actual output because of the tester dynamics for high frequency x-ray production, so don't adjust over 97kV as indicated by testing device.

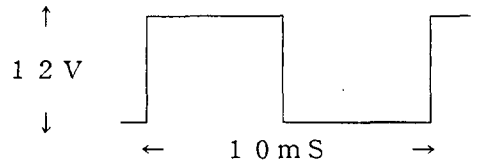
mA adjustment: mA is decreased by turning of VR5 clockwise.

1. This adjustment is need the special test equipment (HF tester).
2. Check the DC voltage between the mA test point (+) and (-) on the HF tester.
3. Set the mA indicator to 20mA and turn VR5 (M3108A) so that the DC voltage is 2.0 VDC.

Exposure time adjustment: Exposure time is decreased by turning clockwise.

Time base is 100 Hz (10 msec.). When short pin of JP2 is pulled out, X-RAY LED is lit not related with timer. Measure voltage between of TIME terminal and GND terminal by Oscilloscope, and adjust by turning VR6.

IMPORTANT Disconnect the connector JP2 on M3108A PC board before pull out short pin of X-ray. Otherwise, inverter board will work and X-ray will be generated unrelated with timer setting and X-ray unit might be broken.
* Put in and pull out connectors at POWER OFF.



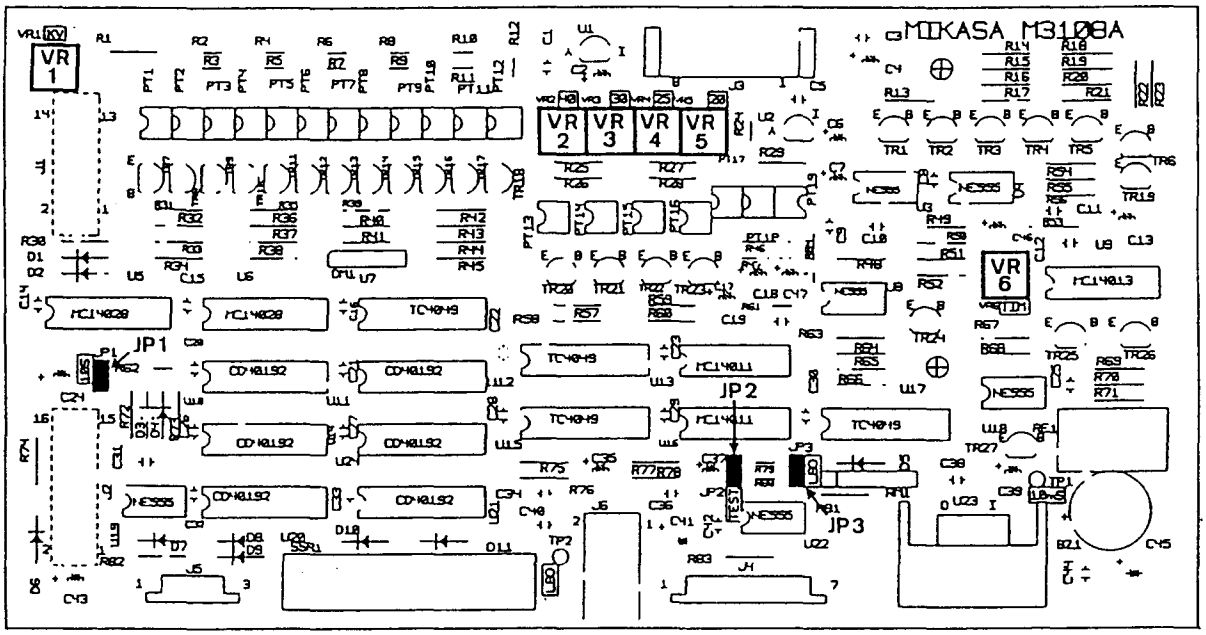
※ TIME BASE WAVEFORM

REFFRENCE: There are three short pins on M3108A (LBD, 10SEC and TEST). Each factors are as follows.

LBD: When put in, lighting time of collimator is 45 sec. When pull out, it is 90 sec.

10SEC: When put in, WARM UP time is 1 sec. When pull out, it is 10 sec. This short pin is for adjustment at factory before shipment. So, don't use the unit with short pin.

TEST: Never pull out this short pin.



3. M9111 PC board adjustments (refer page 9)

adjustment of followings.

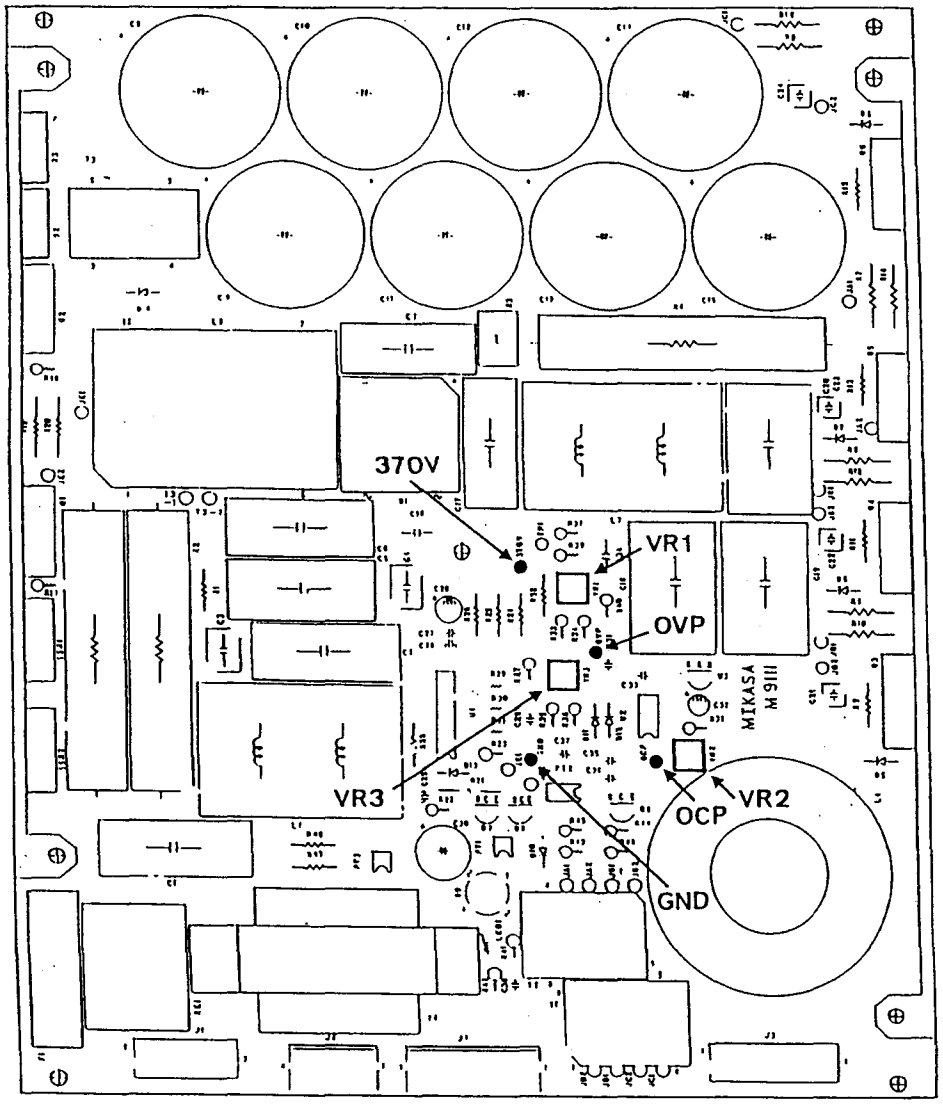
* over voltage protection circuit (VR1)
* over current protection circuit (VR2)
* DC voltage adjust circuit (VR3)

adjusting the DC voltage have to use special equipment.

4. M9112 PC board Adjustments (refer page 10)

Adjustment of frequency of Inverter board. (VR1)
Adjustment of Pre-heat time. (VR3)
Adjustment of kV. (VR4)
Adjustment of mA. (VR5)

M9111 PC BOARD adjustment



This adjustment has to be done after connect all of connectors completely.
But actual exposure is not necessary.

* Each PC boards delivered from Mikasa Factory have already been adjusted.

1. Adjustment of VR3 (DC370V)
   Adjust voltage between 370V (+) and GND (-) to be **368.5 - 372V** by turning VR3.
   Voltage is increased by turning clockwise.

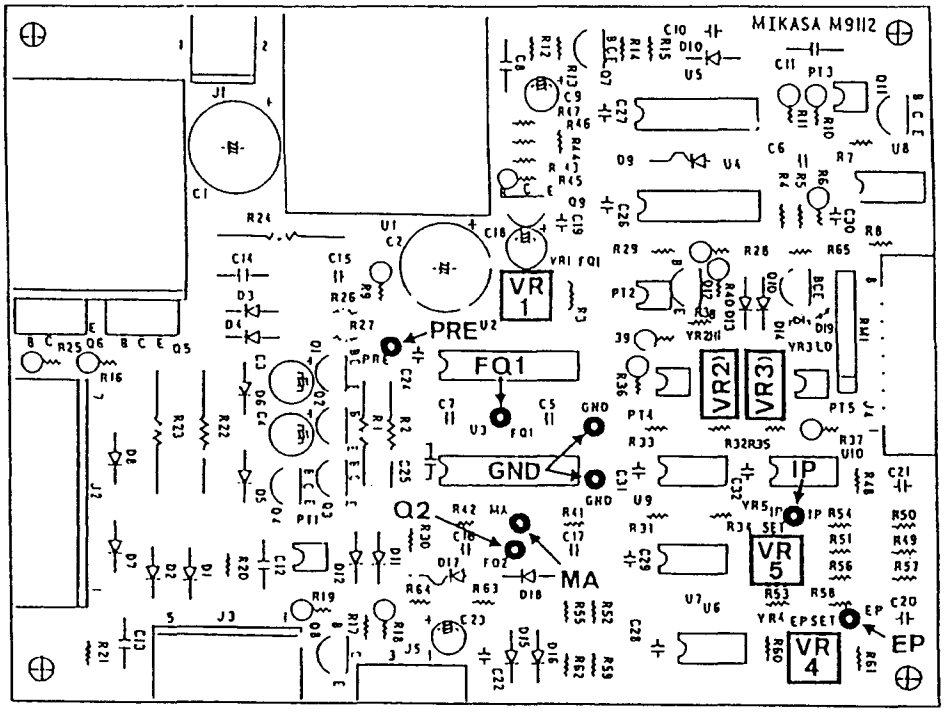
2. Adjustment of VR2 (Over Current Protection circuit)
   Adjust voltage between OCP (+) and GND (-) to be **1.09 - 1.11V** by turning VR2.
   Voltage is increased by turning clockwise.

3. Adjustment of VR1 (Over Voltage Protection circuit)
   Adjust voltage between OVP (+) and GND (-) to be **αV** by turning VR1.
   Voltage is decreased by turning clockwise.

If actual measured voltage would be β, α can be calculated as following.

$$\alpha = \beta \times 0.0061$$

M9112 PC BOARD adjustment



This adjustment has to be done after connect all of connectors completely. But actual exposure is not necessary.

* Each PC boards delivered from Mikasa Factory have already been adjusted.

1. Adjustment of FQ1
   Adjust frequency between FQ1(+) and GND(-) to be 120kHz by turning VR1.
   Frequency is increased by turning clockwise.

2. Check of FQ2
   Check if frequency between FQ2(+) and GND(-) is 90kHz ±5%.

3. Adjustment of Pre-Heat voltage
   Adjust voltage between PRE(+) and GND(-) to be 0.43V by turning VR3.
   Voltage is increased by turning clockwise.

4. Set VR4 (=EP SET) to be center.

6. Set VR5 (=IP SET) to be center.

5. Readjustment of kV

This adjustment has to be done after connect all of connectors completely.
Actual exposure is not necessary.

Note 1: This adjustment requires that an exposure be made. Please observe all radiation related safety precautions.

Note 2: This adjustment must be done whenever an insert or an inverter board (M9101B PCB) is replaced.

Equipment: Dual trace storage oscilloscope and DC voltmeter.

Oscilloscope settings:

Ep @M9102B	Channel 1	1 Volt/Div.
Ip @M9102B	Channel 2	0.5 Volt/Div.
	Time	10 mSec/Div.

DC Voltmeter:

Positive prove	kV @9102B
Negative probe	chasis ground

X-ray unit setting:
70kV · 0.1 sec.

Adjustment VR:

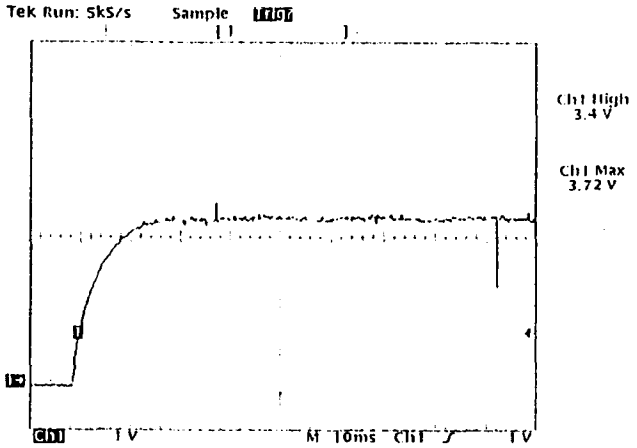
VR4 @M9112B	Check the kV by oscilloscope, and adjust average of peak value of EP wave form by VR4 to be 3.4V. After the adjustment, set X-ray unit to 100kV and adjust average of peak value of EP wave form by VR4 to be 4.4V.

CAUTION) Check the kV by using an external kV tester such as the Victoreen NERO. And do not adjust over 100kV as kV tester has deviation of ±3kV itself. Adjust between 97.5～99kV.

5-1. Adjustment of 70kV by turning VR4

Adjust the CH1 (EP) by VR4 to be 3.4V ±0.5V.

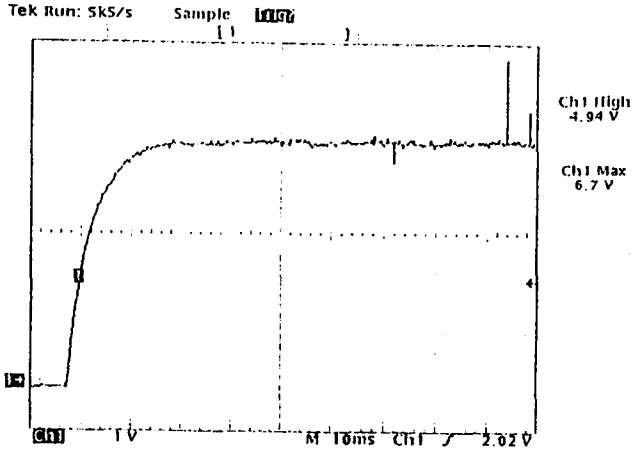
kV is increased by turning clockwise.



5-2. Adjustment of 100kV by turning VR4

Adjust the CH1 (EP) by VR4 to be 4.9V ±0.5V.

kV is increased by turning clockwise.



6. Readjustment of Pre-Heat and mA

This adjustment has to be done after connect all of connectors completely.
Actual exposure is necessary.

Note 1: This adjustment requires that an exposure be made. Please observe all radiation related safety precautions.

Note 2: This adjustment must be done whenever an insert or an M9112 Board is replaced.

Equipment: Dual trace storage oscilloscope.

Oscilloscope settings:

Ep @M9112	Channel 1	1.0 Volt/Div.
Ip @M9112	Channel 2	1.0 Volt/Div.
	Time	10 mSec/Div.

X-ray unit setting:

60kV · 0.1 sec.
80kV · 0.1 sec.

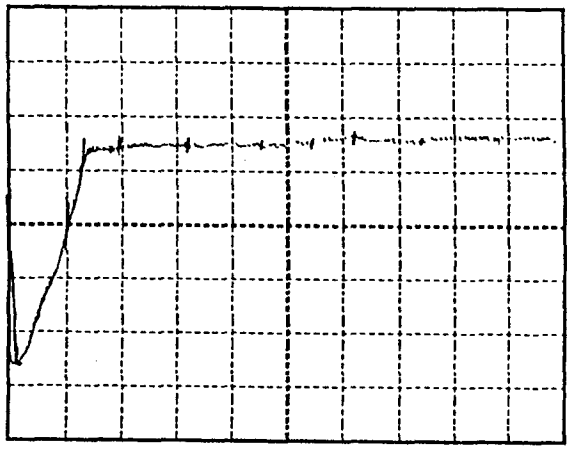
Adjustment VR:

VR3 @M9112 Set kV to 82kV·20mA.
Adjust Pre-heat time to 30 msec ±10%.
Pre-heat time is decreased by turning clockwise.

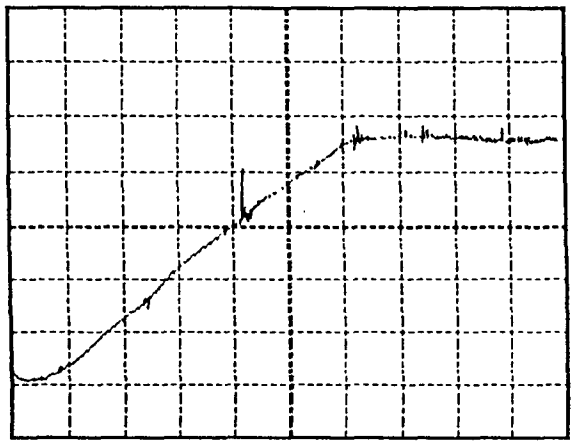
VR5 @M9112 Adjustment of mA.
Adjust to 19mA.

6-1. Adjustment of Pre-heat Time by turning VR2·VR3

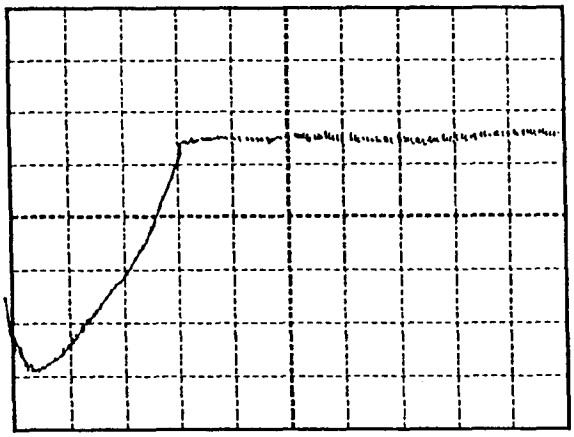
1. Pre-heat Time is short. Make Pre-heat Time longer by turning VR3 counterclockwise.



2. Pre-heat Time is long. Make Pre-heat Time shorter by turning VR3 clockwise.



3. Pre-heat Time is correct.

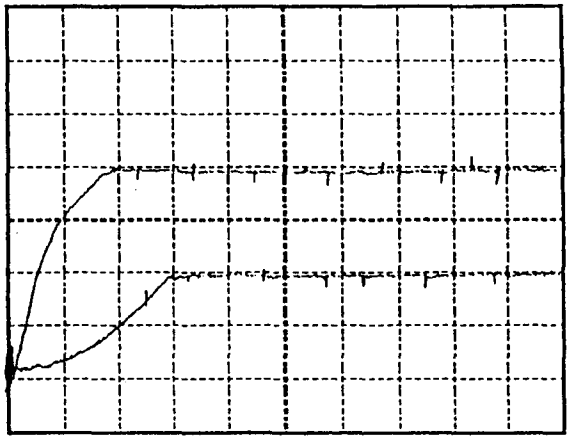


* Acceptable limit 20 msec - 40 msec

6-2. Adjustment of mA by turning VR5

※ Adjust average of peak value of IP wave form to be 1.9V by turning VR5.

※HF100： 80kV・20mA



7. Readjustment of exposure time

This adjustment has to be done after connect all of connectors completely.
Actual exposure is necessary.

Note 1: This adjustment requires that an exposure be made. Please observe all radiation related safety precautions.

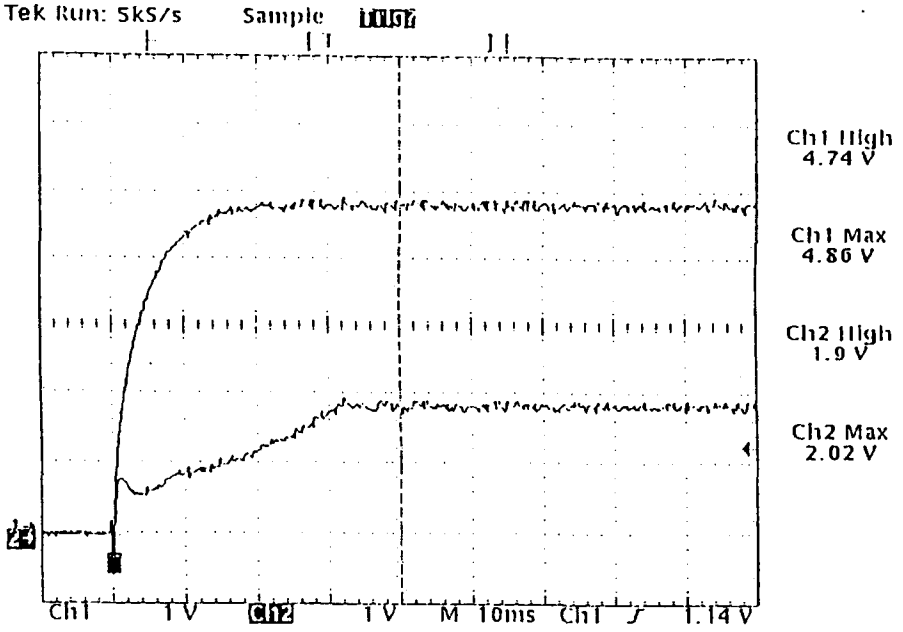
Check the exposure time by using an external exposure time meter such as the VICTOREEN NERO.

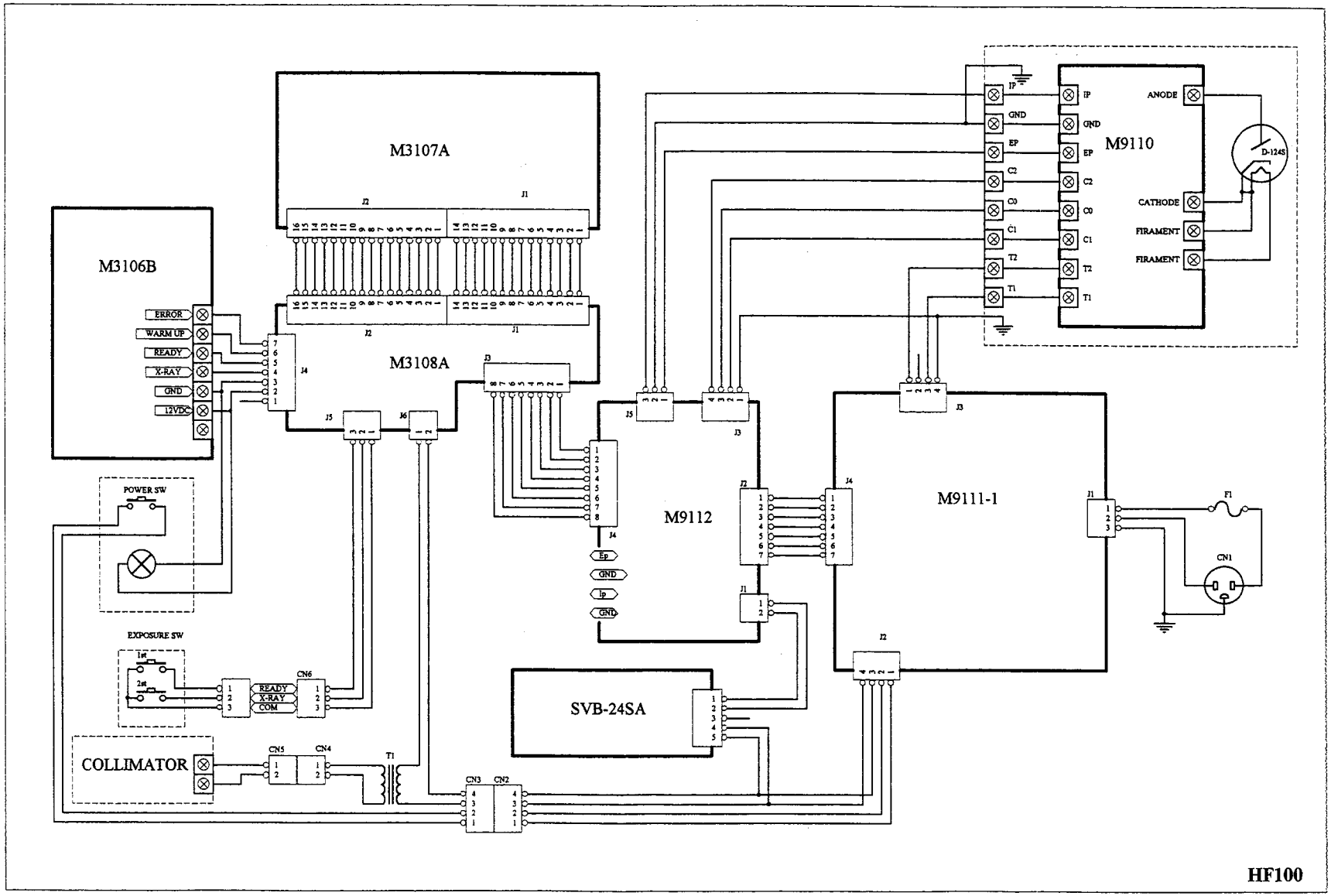
X-ray unit setting: 82kV · 0.5 sec.

Adjustment: Exposure time is decreased by turning clockwise.
(VR6 on the M3108A PC board)

Nomal Waveform

100kV · 20mA




M3107A
M3106B
M3108A
M9110
M9112
M9111-1
SVB-24SA
D-124S
ANODE
CATHODE
FIRAMENT
FIRAMENT
IP
GND
EP
C2
C0
C1
T2
T1
ERROR
WARM UP
READY
X-RAY
GND
12VDC
POWER SW
EXPOSURE SW
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2nd
READY
X-RAY
COM
COLLIMATOR
CN1
CN2
CN3
CN4
CN5
CN6
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F1
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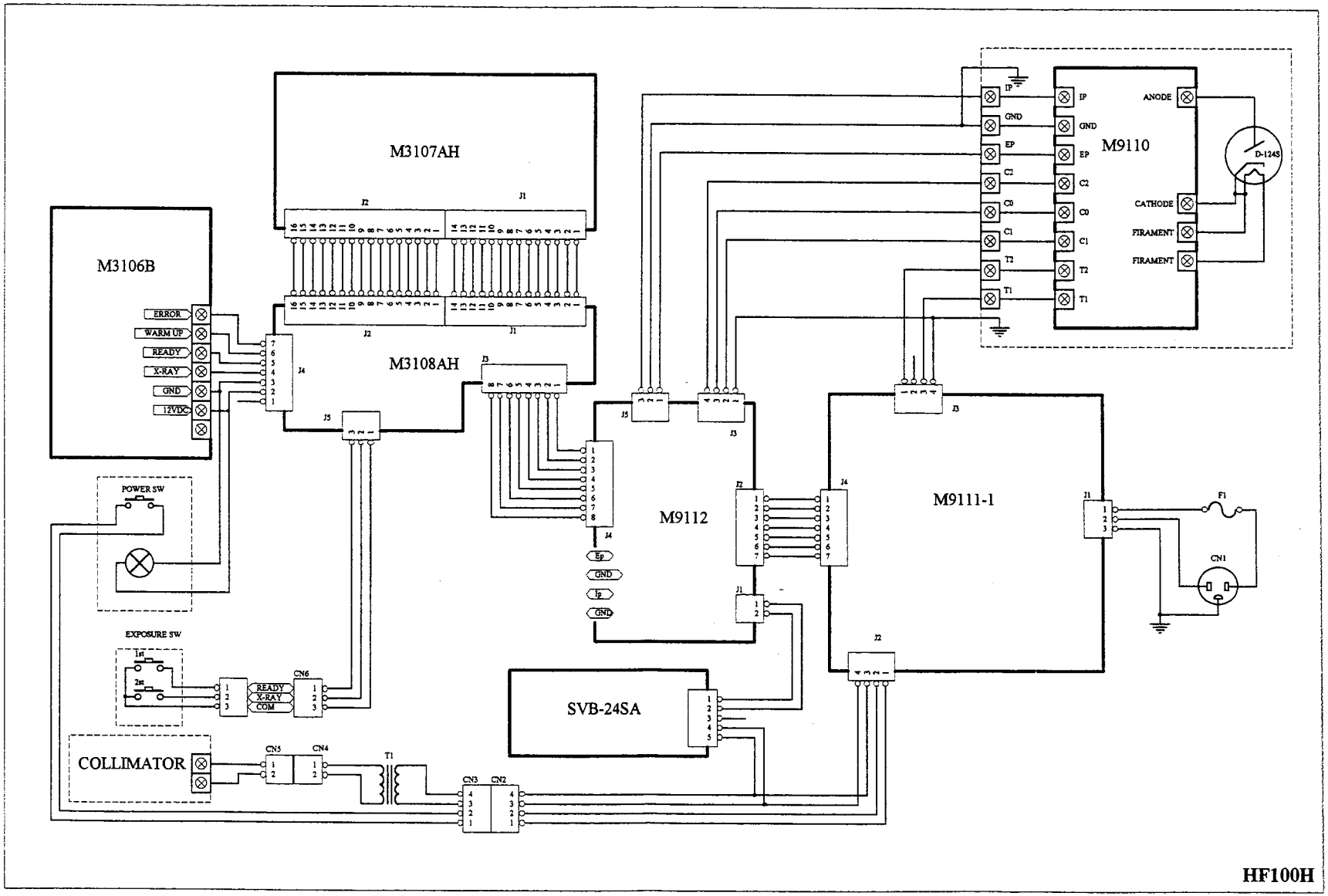
GND
Ip
GND
HF100


M3107AH
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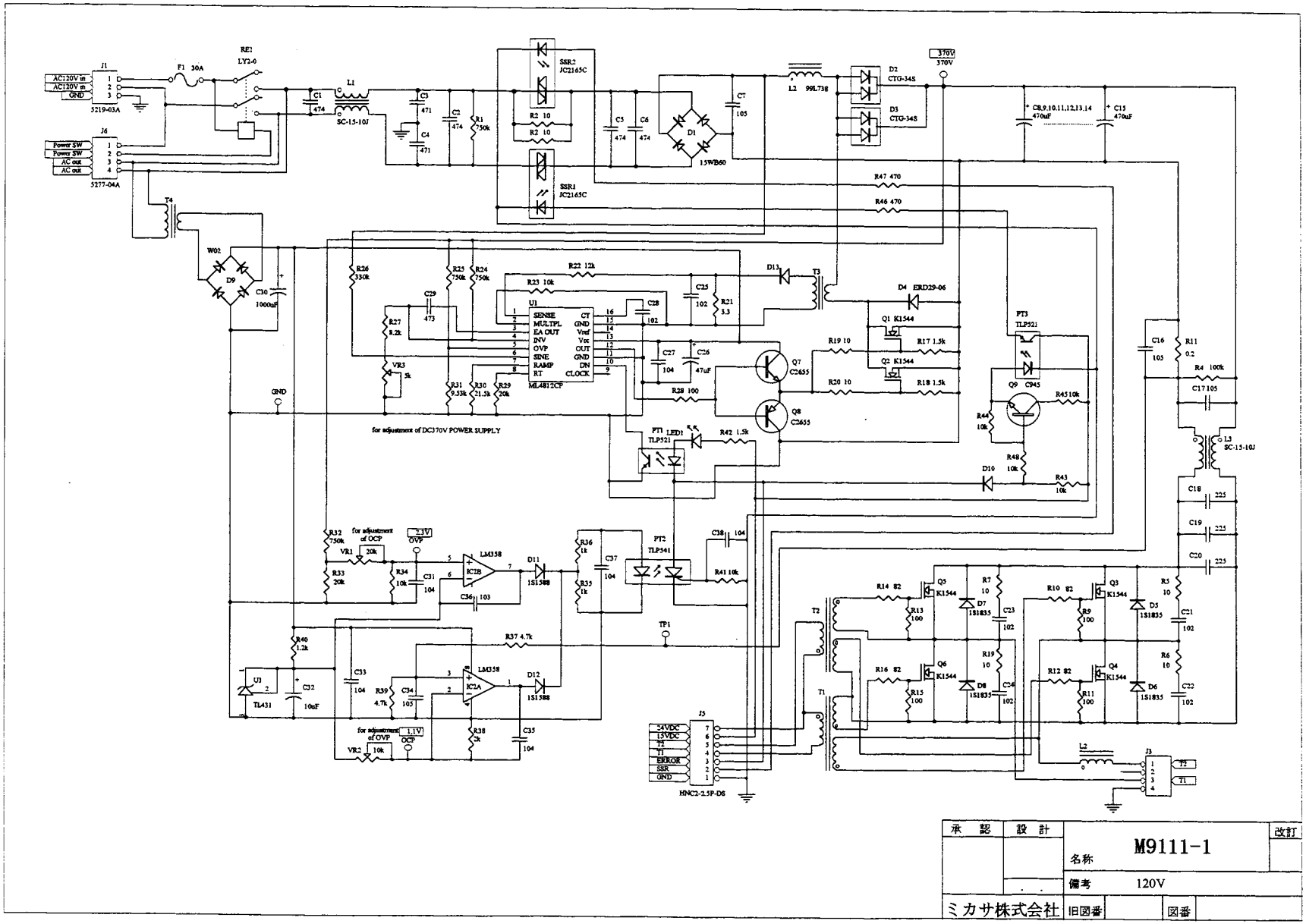
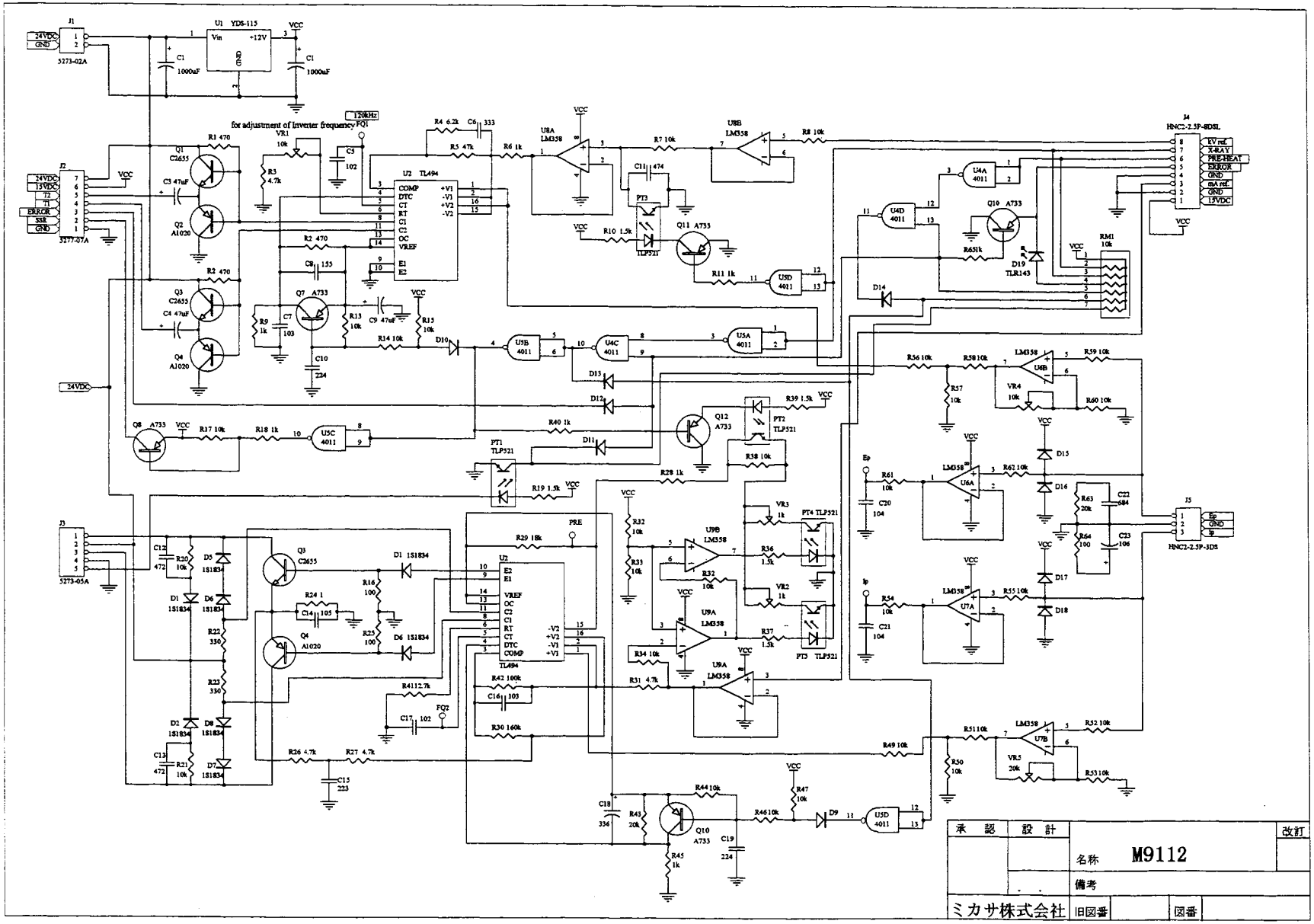


承認	設計	M9111-1	改訂
		名称	
		備考 120V	
ミカサ株式会社		旧図番	図番


for adjustment of Inverter frequency FQ1
120kHz
TL494
LM358
TLP521
M9112
ミカサ株式会社
承認
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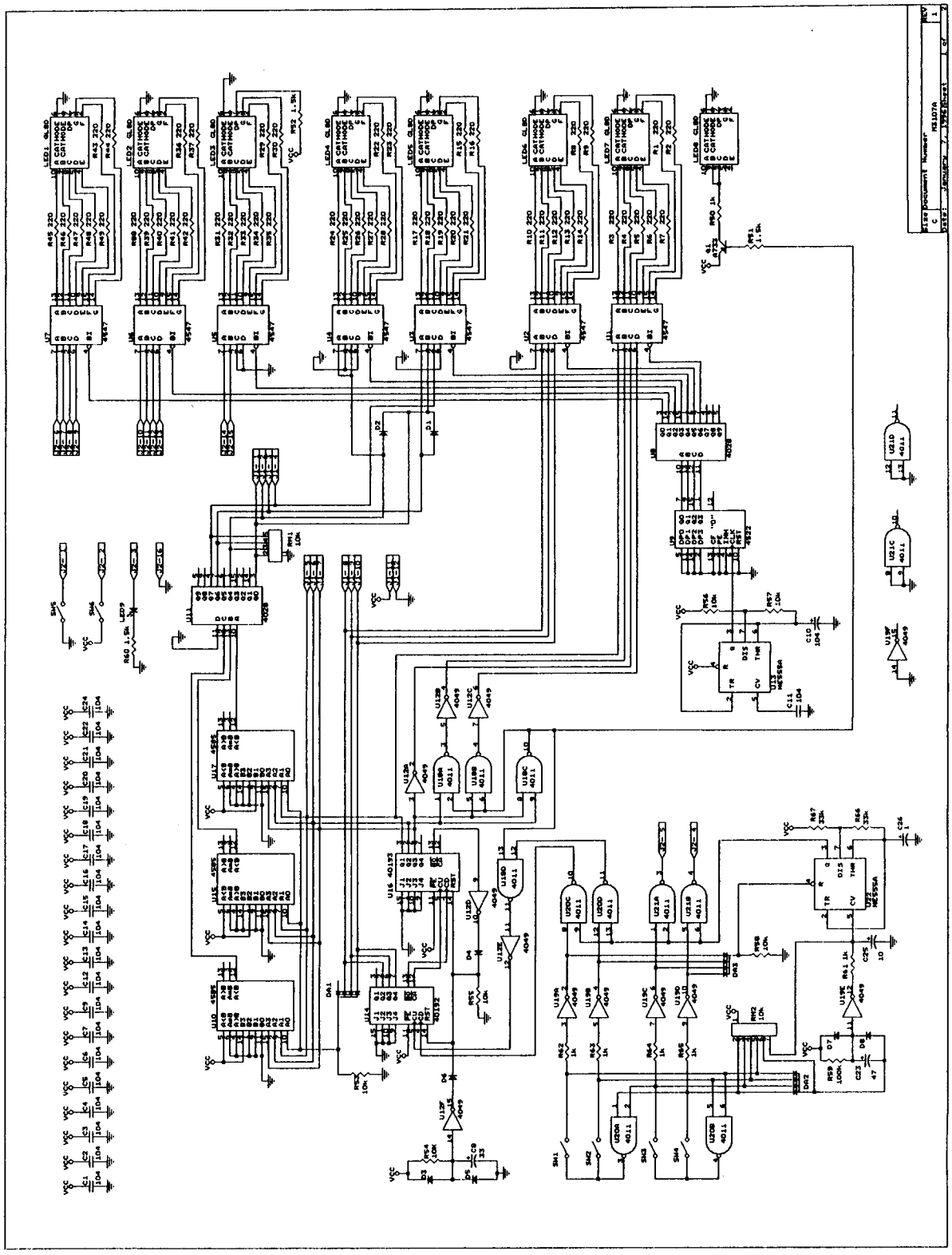

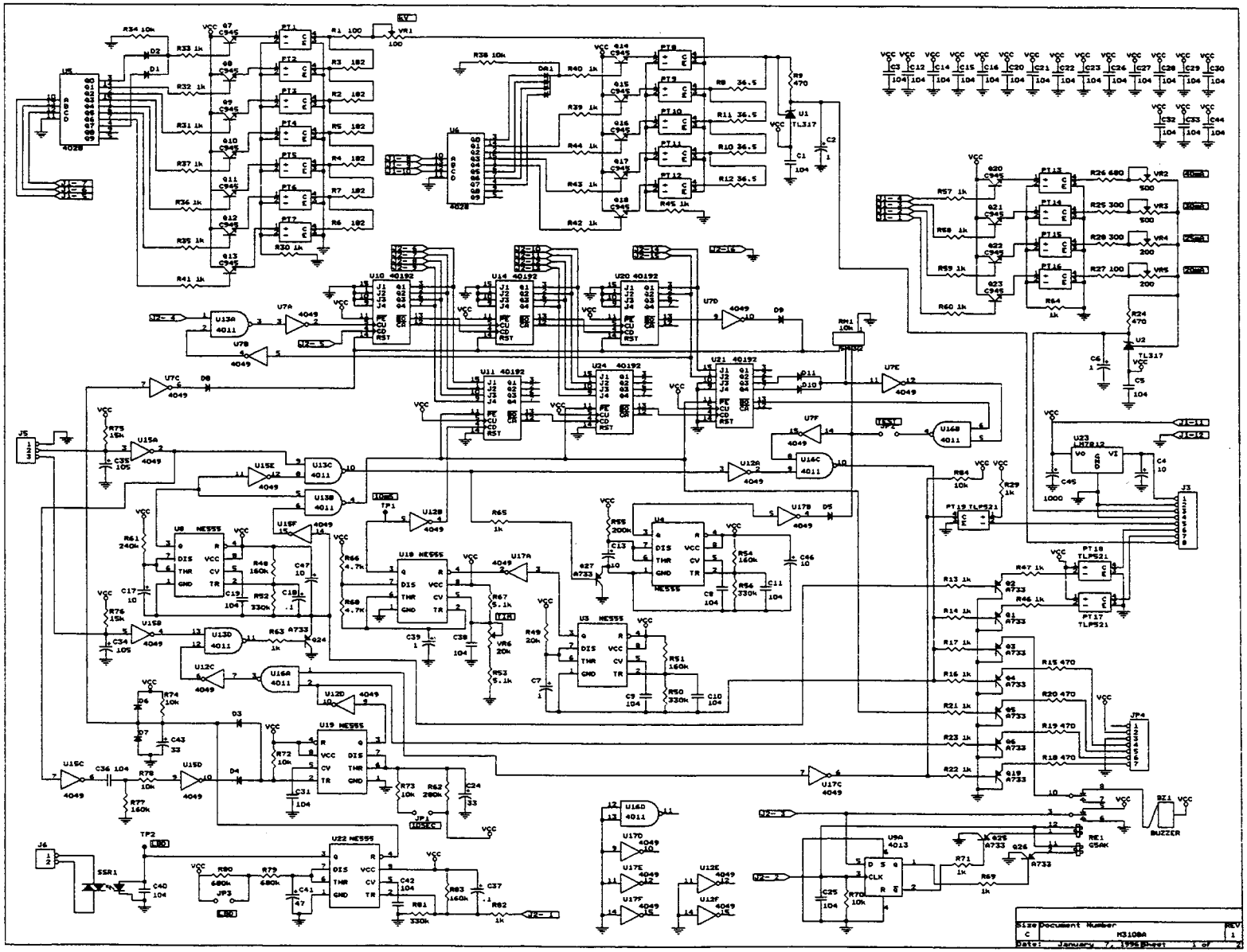

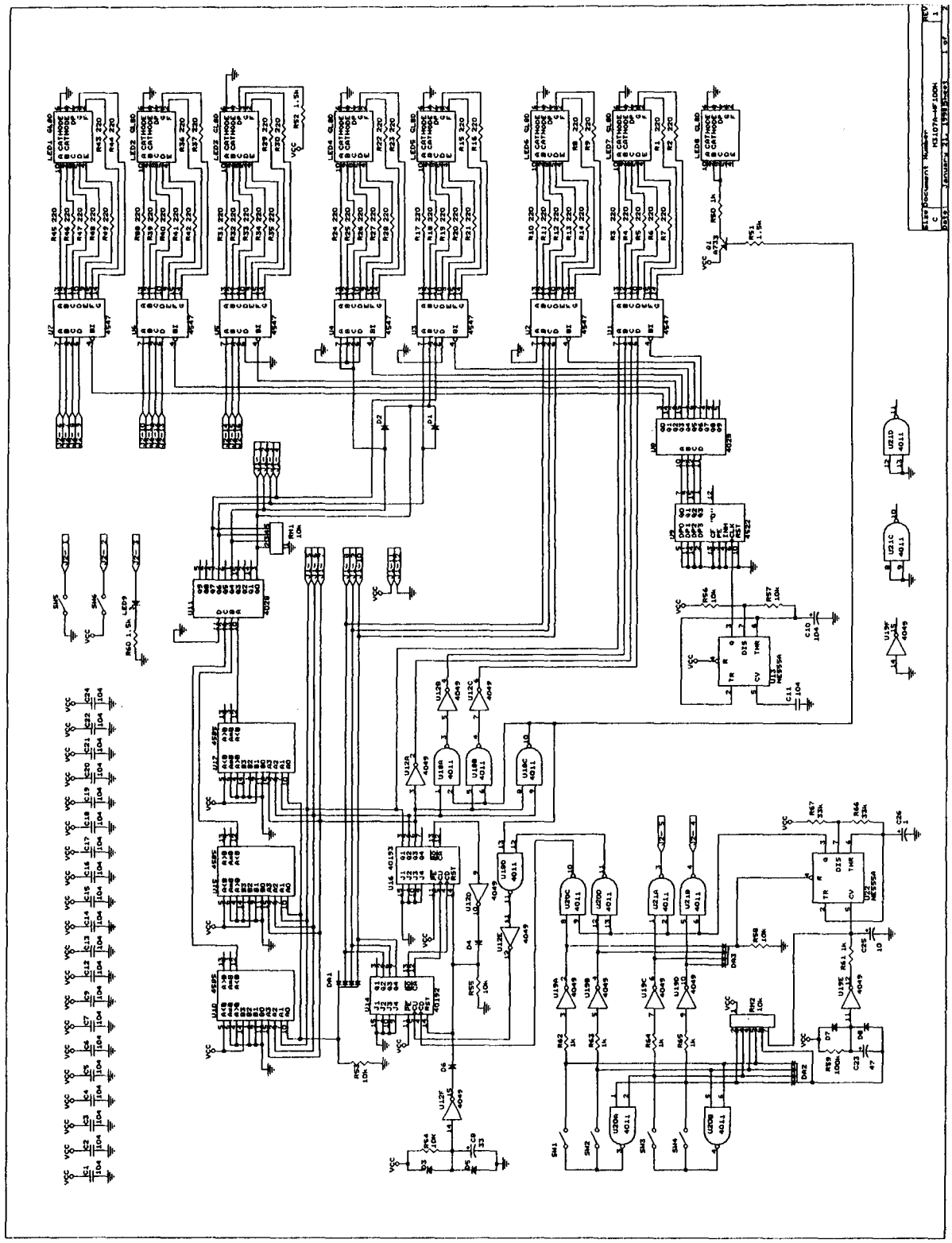

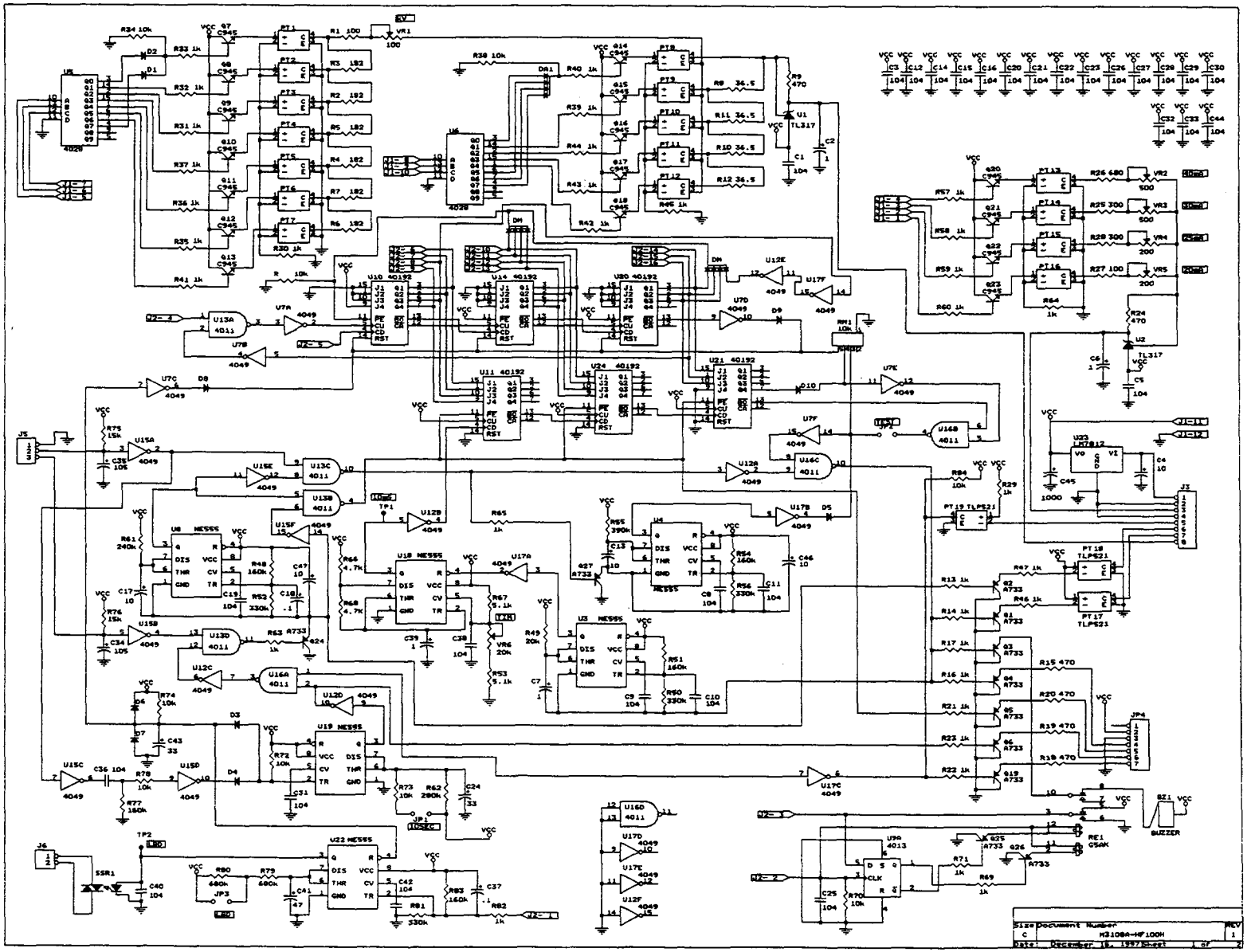

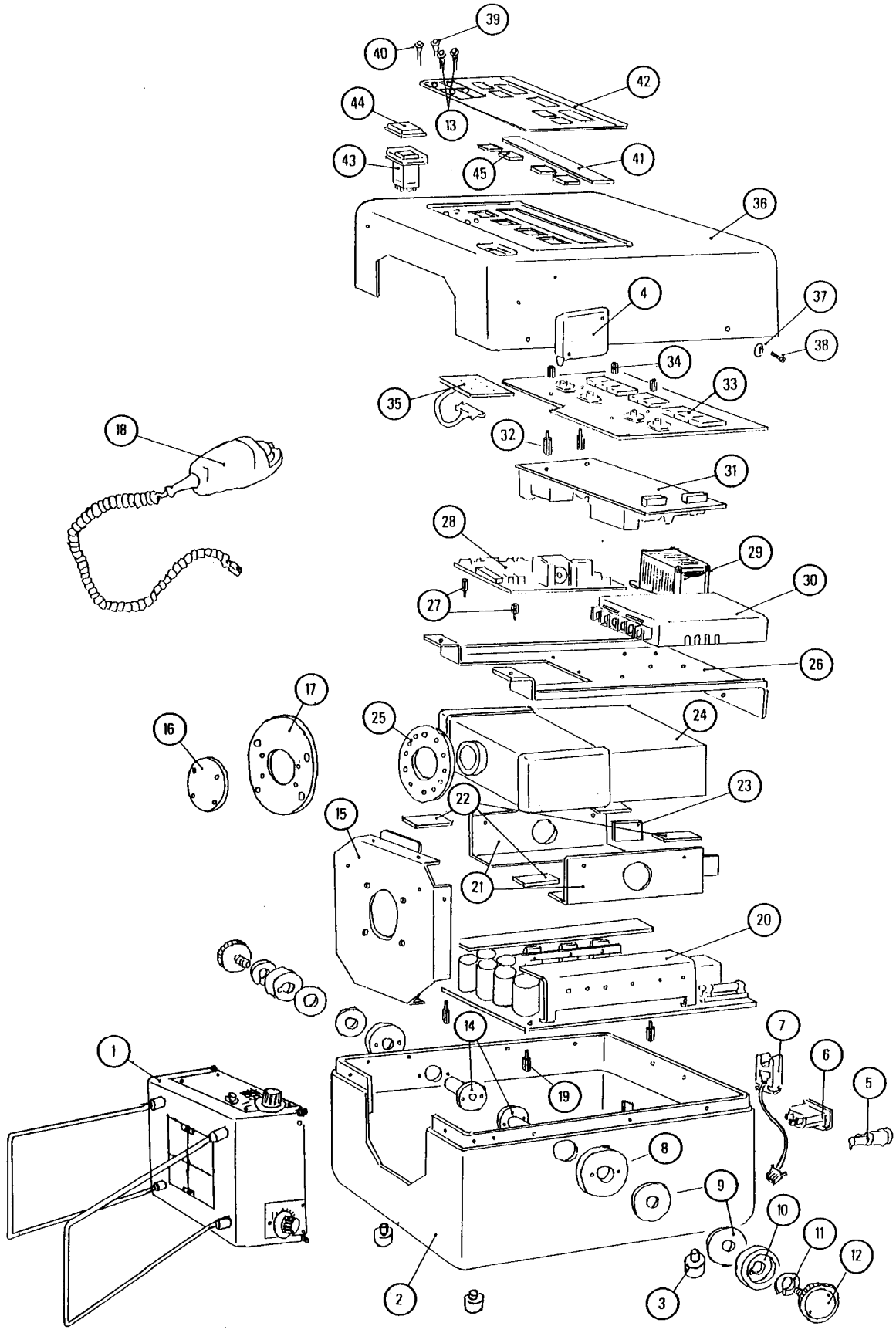
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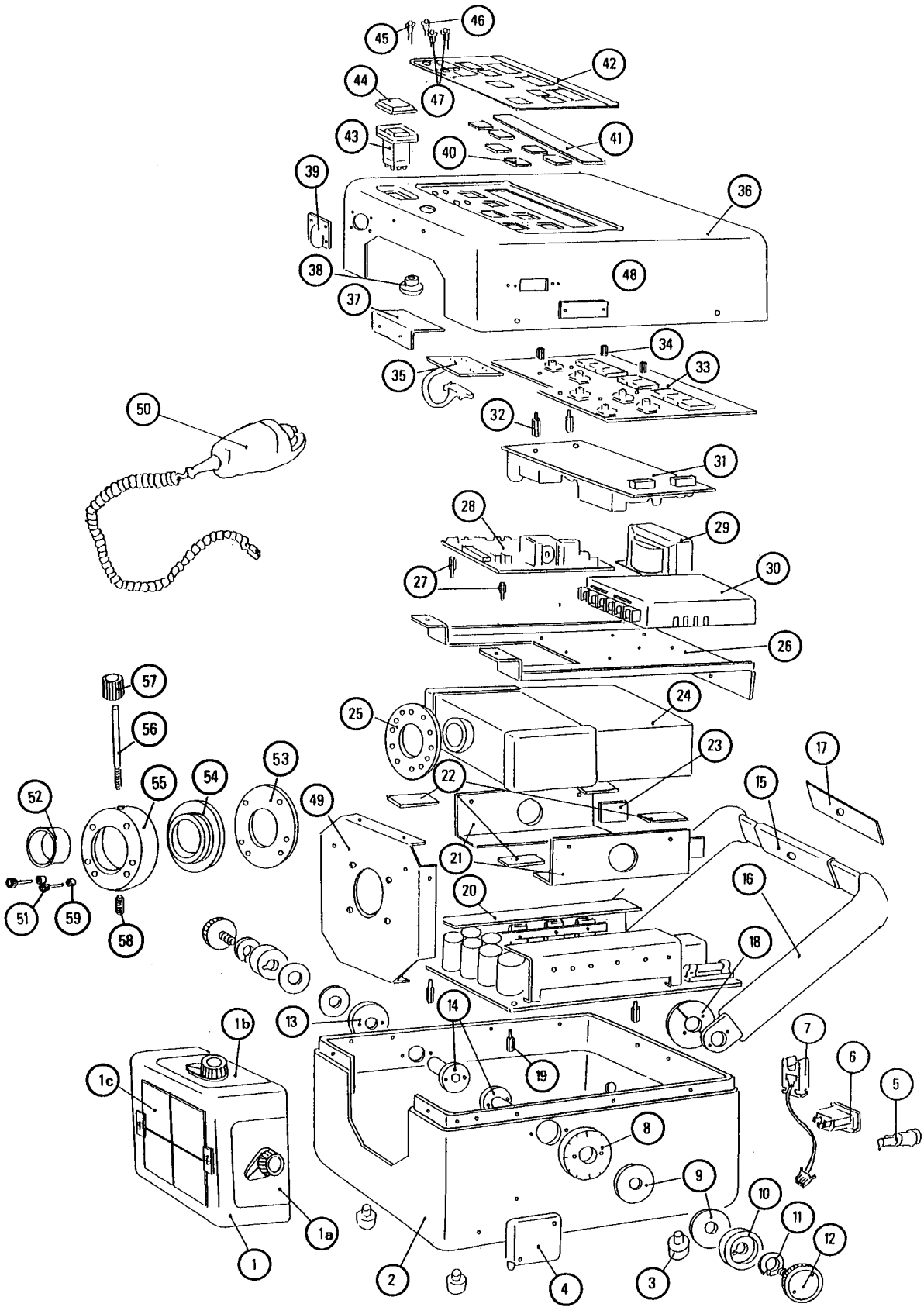
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PARTS PRICE LIST FOR MINXRAY HF100H

INDEX NO.	PARTS NO.	DESIGNATION
1	-	Collimator (R-72)
2	10749	Case bottom for HF100H (Yellow)
3	10586	Plastic foot (TM-127 No.2)
4	10753	Tape measure (Yellow)
5	10688	Fuse holder
6	10754	3-pin power receptacle (CM-11)
7	10755	Exposure switch cord receptacle (65902-004)
8	10690	Mounting plate (without degrees)
9	10081	Nylon washer
10	10082	Metal spacer
11	10083	Split lock washer
12	10084	Holding screw
13	10715	LED indicating lamp (Red)
14	10259	Holding part
15	10756	Front panel (Yellow)
16	10735	Collimator mounting ring
17	10736	Spacer for collimator
18	10732	Exposure switch cord complete
19	10585	Spacer (M3x10)
20	10761	M9111 PC board (Inverter)
21	10692	Side frame
22	10694	Rubber plate (Bottom)
23	10693	Rubber plate (Side)
24	10695	IF701 insert box (HF100/200)
25	10590	Brass ring
26	10696	Chassis
27	10697	Spacer (M3x5)
28	10718	M9112 PC board (Control)
29	10757	Collimator transformer
30	10750	SVB24SA PC board
31	10719	M3108 PC board (Timer)
32	10585	Spacer (M3x10)
33	10701	M3107 PC board (Key board)
34	10702	Spacer (M3x6)
35	10703	M3106 PC board (with cord) (Indicator)

PARTS PRICE LIST FOR MINXRAY HF100H

INDEX NO.	PARTS NO.	DESIGNATION
36	10748	Case top complete labeling (Yellow) HF100H
37	10758	Finishing washer (M3)
38	10759	Oval head phillips screw (3x8)
39	10714	LED indicating lamp (Orange)
40	10713	LED indicating lamp (Green)
41	10709	Plastic shield plate
42	10760	Sheet key plate
43	10711	Power switch
44	10712	Power switch sheld (MURON-FH)
45	10708	Rubber block

PARTS PRICE LIST FOR MINXRAY HF100

INDEX NO.	PARTS NO.	DESIGNATION
1	10606	Collimator R-120H M2 (yellow)
1a	10607	Indication plate (IN)
1b	10608	Indication plate (OUT)
1c	10541	Plastic front for collimator
2	10762	Case bottom (Yellow)
3	10586	Plastic foot (TM-127 No.2)
4	10753	Tape measure (Yellow)
5	10688	Fuse holder
6	10754	3-pin power receptacle (CM-11)
7	10755	Exposure switch cord receptacle (65902-004)
8	10689	Mounting plate (without degrees)
9	10081	Nylon washer
10	10082	Metal spacer
11	10083	Split lock washer
12	10084	Holding screw
13	10690	Mounting plate (without degrees)
14	10259	Holding part
15	10703	Handle (yellow)
16	10594	Rubber grip
17	10265	Ornament plate
18	10682	Indicating plate
19	10585	Spacer (M3x10)
20	10761	M9111 PC board (Inverter) 120V
21	10692	Side frame
22	10694	Rubber plate (Bottom)
23	10693	Rubber plate (Side)
24	10695	IF701 insert box (HF100/200)
25	10590	Brass ring
26	10696	Chassis
27	10697	Spacer (M3x5)
28	10698	M9112 PC board (Control)
29	10764	Collimator transformer (HT-121)
30	10750	SVB24SA PC board (100V)
31	10700	M3108 PC board (Timer)
32	10585	Spacer (M3x10)

PARTS PRICE LIST FOR MINXRAY HF100

INDEX NO.	PARTS NO.	DESIGNATION
33	10701	M3107 PC board (Key board)
34	10702	Spacer (M3x6)
35	10703	M3106 PC board (with cord) (Indicator)
36	10765	Case top (Yellow)
37	10705	Mounting plate for level indicator
38	10706	Level indicator
39	10707	Cord hood
40	10708	Rubber block
41	10709	Plastic shield plate
42	10710	Sheet key plate
43	10711	Power switch
44	10712	Power switch sheld (MURON-FH)
45	10713	LED indicating lamp (Green)
46	10714	LED indicating lamp (Orange)
47	10715	LED indicating lamp (Red)
48	10716	Cover plate
49	10766	Front panel (Yellow)
50	10732	Exposure switch complete
51	10767	Cap bolt (4M-5)
52	10584	Lead cap with 1.0mm Al. Filter
53	10768	Nut plate
54	10769	Collimator mounting ring (HF200,HF100) 110V
55	10770	Rotating pedestal of collimator
56	10771	Shaft for collimator roration
57	10772	Knob for collimator rotation (MSA-14S)
58	10773	Ball plunger (BSU6)
59	10774	Spacer for collimator rotation (4ER-3)